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ABSTRACT

This research characterizes how the mental lexicon functions during sentence processing. In sentence processing, access of meaning is seen to be dependent on interaction between syntactic and semantic information within the sentence. It had been previously thought that meaning had been located in an independent mental lexicon. Three experiments were conducted to determine the strength of the predictive and selective linguistic contexts used to disambiguate an ambiguous word. Examination of the data regarding the separate contributions of syntactic and semantic contextual clues revealed that semantic clues provided greater assistance in direct access of meaning than do syntactic contextual clues. Predictive contexts were shown to be more useful in meaning determination than selective contexts were. Expanding the semantic contextual clues greatly facilitated speed and accuracy of meaning access. (PMJ)

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Lexical Access During Sentence Processing

The purpose of this research is to characterize how the mental lexicon functions during sentence processing. The basic issue is whether the mental lexicon functions autonomously or interacts with other linguistic and non-linguistic components. It is our hypothesis that syntactic and semantic information within a sentence influence the access of meaning from the mental lexicon.

Until recently, meaning access was thought to be largely independent of the surrounding context (Conrad, 1974; Foss & Jenkins, 1973; Holmes, Arwas & Garrett, 1977). Psychologically, the lexicon was hypothesized to be functionally independent of other linguistic processing systems just as many linguists treated the lexicon as formally distinct from other linguistic components. The strongest view taken by psycholinguists was that all of the syntactic and semantic information listed with a word in the lexicon was activated whenever a lexical item was accessed. For ambiguous words, this meant that all of the meanings were accessed even if they were inappropriate to the surrounding linguistic context. The mental lexicon, then, was thought to be functionally autonomous, always making the same contribution. Another proposal was a weak interactive model in which the surrounding linguistic context could be utilized to search through a set of meanings (Forster, 1976; Hogaboam & Perfetti, 1975). This search terminated as soon as an appropriate meaning was found. Meanings were usually thought to be ordered and search on the basis of their frequency of use.

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Our basic hypothesis is that the mental lexicon is organized to allow, with sufficient context, direct access of a particular meaning. That is, the only time more than one meaning is accessed is when the context is not sufficient enough to exclude the other meaning. To test our hypothesis of direct access of meaning, we have utilized two types of prior disambiguating context: predictive and selective. Predictive contexts are the strongest contexts since in addition to favoring one meaning, they exclude the other meaning. Selective contexts, while strongly favoring one meaning, do not exclude the other meaning. So, our research takes a closer look at the nature of the strength of the linguistic contexts used to disambiguate an ambiguous word. We are also interested in the separate contributions of syntactic and semantic contextual cues. These have been often confounded in psycholinguistic research, and so a theory of processing which directly incorporates a competence grammar which treats these systems as autonomous has alluded direct empirical test.

At the sentence level, it is fairly difficult to isolate syntactic from semantic cues. Our approach was to choose ambiguous words with mass and count meanings. Count nouns, as their name implies, can be individuated by counting. So we can have "a dog," "one dog," "two dogs." Mass nouns, on the other hand, cannot be individuated, so we do not get "a sand," "one sand," "two sands" (unless elliptically referring to types of sand).

For our experiments, we chose 20 ambiguous nouns with both mass and count meanings, such as yarn, solution, iron, pool, punch, batter, etc. The task for these experiments was a category judgement task. Subjects heard a sentence

which always ended with the ambiguous word. Following the ambiguous word was a category word. The subjects had to say whether the last word in the sentence could be included in the category named by the word that followed. Some examples are shown in Table 1.

Table 1
Prior Disambiguating Contexts

	Semantic	Syntactic
Predictive	Tim {landed drank} the punch {boxing beverage}	Bill is easily entertained by watching {a pool} {water billiards}
Selective	The {crowd baker} stirred up the batter {player mixture}	If you need {one more} I'll leave you the solution {answer liquid}

Some subjects heard the sentence "Tim landed the punch" followed by boxing while other subjects heard the same sentence followed by beverage. The instructions to the subject made no reference to the sentence itself, only that the judgement should be made between the last word and the word that followed. So we did not tell them to use the context.

For the first experiment, contexts were either predictive or selective. As you can see in Table 1, the predictive contexts exclude the other meaning while the selective contexts do not. The linguistic cues were either semantic or syntactic. In every case, we only changed one word to bias the context toward the other meaning. So in the punch example, landed is changed to drank. In the syntactic example with pool, the indefinite article which cues the swimming pool meaning is dropped to get the billiards meaning. Other syntactic cues we used were a versus some, one versus more. We were interested to see if subjects

could use these subtle syntactic cues to access the intended meaning. And, if they could use them, how effective were they as compared to semantic cues.

If our direct access hypothesis is correct, we would expect, in at least the predictive contexts, that only one meaning is accessed and this should be reflected in the subject's category judgements and in their reaction times to make those judgements. The direct access hypothesis would predict that subjects should respond "no" to "Tim drank the punch. boxing" while responding "yes" to "Tim drank the punch. beverage". The proposal that there is an independent lexicon would predict that subjects would say "yes" in both cases because on this view all of the meanings of punch are automatically activated and thus are available for both category judgements. An ordered search model would predict that subjects would say "no" only in one case, i.e., when the context is biased toward the more frequent meaning and the category word is related to the less frequent meaning. Neither the independent lexicon model nor the ordered search model would distinguish predictive from selective contexts, as this distinction is based on the exclusion of one meaning; a process inherently ruled out by these models.

Our results confirm the predictions of the direct access hypothesis. Table 2 shows the percentage of responses predicted by the interactive model.

Table 2

Results for Experiment 1
Percentage of Predicted Responses

	<u>Semantic</u>		<u>Syntactic</u>	
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
<u>Predictive</u>	83.0%	81.3%	81.7%	69.0%
<u>Selective</u>	72.0%	51.9%	66.0%	44.9%

Looking first at the predictive context in the semantic cue condition, the most striking result is that subjects say "no" 81% of the time, i.e., subjects say "no" to "Tim drank the punch. boxing". Thus, it appears that with sufficient context, subjects are accessing only one meaning even though the category word actually gives them the other meaning. Subjects responded "no" to a lesser extent in the other conditions but it is impressive that they are still saying "no" more often than not. Even in the syntactic cue condition, where the indefinite article a is dropped or just changed to some, subjects are able to use these subtle cues to direct access to just one meaning. As expected, some contexts direct access better than others. Predictive contexts overall produced more expected responses than selective contexts. This was true for the "yes" responses as well as for the "no" responses. The reaction time data paralleled the accuracy data with RT's averaging 2 seconds. These results suggest that subjects actively utilized the context to direct their access.

We also analyzed the results on the basis of meaning frequency and found that this was not a significant factor, thus ruling out an ordered search model.

This first experiment, then, suggests that as syntactic parsing and semantic composition proceed on-line, the resultant interaction is used to direct lexical access to a single meaning of an otherwise ambiguous word. This would explain the fact that most ambiguities go unnoticed. Thus we expect that ambiguous words with sufficient prior disambiguating context should be processed no differently than unambiguous words. This was tested in Experiment 2. As seen in Table 3, we substituted an unambiguous synonym for each meaning of an ambiguous word. So, "The car was stuck in the jam. traffic" became "The car was stuck in

the pile-up. traffic".

Table 3
Experiment 2
Unambiguous Controls

Semantic (Predictive & Selective)	Unambiguous
The {car knife} was stuck in the jam {traffic sweets}	The {car knife} was stuck in the {pile-up jelly} {traffic sweets}

RESULTS

Accuracy and RT (in seconds) for Ambiguous Words and
Corresponding Unambiguous Controls

	<u>Yes</u>		<u>No</u>	
	<u>Acc</u>	<u>RT</u>	<u>Acc</u>	<u>RT</u>
<u>Ambiguous</u>	85.5%	1.822	63.3%	1.965
<u>Unambiguous</u>	91.3%	1.861	94.5%	1.955

The results show no differences in reaction time between ambiguous words and their unambiguous counterparts. So our hypothesis that ambiguous words in these contexts are processed similarly to unambiguous words was confirmed. The reason that the accuracy for the "no" responses was only 63% was because the ambiguous condition in this experiment included selective as well as predictive contexts.

The main result from these first two experiments is that meaning access is directed by the context. Just a single cue, whether syntactic or semantic, turns out to be sufficient to restrict access to a particular meaning. We used only a single cue for two reasons: 1) this enabled us to investigate the separate contributions of syntax and semantics and 2) we wanted to show that these cues were part of sentence processing and not simply a function of discourse

processing. After finding the minimal level at which these cues operate, we decided to increase the context to see if we could facilitate lexical access. This more closely approximates normal sentence processing where the linguistic and pragmatic contexts provide a variety of cues, many of which may be redundant.

In the third experiment, we increased the context preceding the ambiguous word to two semantic cues by interchanging the ambiguous word with the category word. So "Mrs. Guires told the yarn. story" became "Mrs. Guires told the story. yarn". If our hypothesis is correct, the combination of "told" and "story" should facilitate the lexical access of the appropriate meaning of "yarn." As can be seen in Table 4, both accuracy and reaction time were significantly facilitated by the additional context. If the mental lexicon were independent, a simple word order reversal should not affect the reaction times or these judgements.

Table 4
Experiment 3
Increased Context

Semantic (Predictive & Selective)	Reversed Judgement (ambiguous word followed sent.)
Mrs. Guires {told sold} the yarn {story textile}	Mrs. Guires {told sold} the {story textile} -yarn
RESULTS	
<u>Semantic</u>	<u>Reversed Judgement</u>
<u>Acc</u> <u>RT</u>	<u>Acc</u> <u>RT</u>
73.0% 1.970	91.2% 1.695* (p < .01)

These experiments provide empirical support for an interactive model of sentence processing. We have demonstrated that lexical access is influenced by other linguistic components. Although we have not made any claims about

the organization of the mental lexicon, we have shown it affords access through either syntactic or semantic channels. We believe that the results from these experiments can only be accounted for by hypothesizing that the formally distinct syntactic and semantic components functionally interact in a psychological model of sentence processing.

References

- Conrad, C. Context effects in sentence comprehension: A study of the subjective lexicon. Memory & Cognition, 1974, 2(1A), 130-138.
- Forster, K.I. Accessing the mental lexicon. In R. J. Wales & E. Walker (Eds.), New approaches to language mechanisms. New York: North-Holland, 1976.
- Foss, D. J. & Jenkins, C. M. Some effects of context on the comprehension of ambiguous sentences. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 577-589.
- Hogaboam, T. W. & Perfetti, C.A. Lexical ambiguity and sentence comprehension. Journal of Verbal Learning and Verbal Behavior, 1975, 14, 265-274.
- Holmes, V. M., Arwas, R., & Garrett, M. F. Prior context and the perception of lexically ambiguous sentences. Memory & Cognition, 1977, 5(1), 103-110.